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IMPLEMENTATION PLAN REVIEW FOR ARIZONA AS REQUIRED BY THE ENERGY SUPPLY AND ENVIRONMENTAL COORDINATION ACT

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Section IV of the Energy Supply and Environmental Coordination Act of 1974, (ESECA) requires EPA to review each State Implementation Plan (SIP) to determine if revisions can be made to control regulations for stationary fuel combustion sources without interferring with the attainment and maintenance of the national ambient air quality standards. This document, which is also required by Section IV of ESECA, is EPA's report to the State indicating where regulations might be revised.

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IMPLEMENTATION PLAN REVIEW

FOR

ARIZONA

REQUIRED BY THE ENERGY SUPPLY AND ENVIRONMENTAL COORDINATION ACT

PREPARED BY THE FOLLOWING TASK FORCE:

U. S. Environmental Protection Agency, Region IX
100 California Street
San Francisco, California 94111

Environmental Services of TRW, Inc.
(Contract 68-02-1385)

U. S. Environmental Protection Agency
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

December 1974

ARIZONA

ENERGY SUPPLY AND ENVIRONMENTAL COORDINATION ACT

(SECTION IV - STATE IMPLEMENTATION PLAN REVIEW)

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1.0 EXECUTIVE SUMMARY

The enclosed report is the U. S. Environmental Protection Agency's (EPA) response to Section IV of the Energy Supply and Environmental Coordination Act of 1974 (ESECA). Section IV requires EPA to review each State Implementation Plan (SIP) to determine if revisions can be made to control regulations for stationary fuel combustion sources without interfering with the attainment and maintenance of the National Ambient Air Quality Standards (NAAQS). In addition to requiring that EPA report to the State on whether control regulations might be revised, ESECA provides that EPA must approve or disapprove any revised regulations relating to fuel burning stationary sources within three months after they are submitted to EPA by the States. The States may, as in the Clean Air Act of 1970, initiate State Implementation Plan revisions; ESECA does not, however, require States to change any existing plan.

Congress has intended that this report provide the State with information on excessively restrictive control regulations. The intent of ESECA is that SIP's, wherever possible, be revised in the interest of conserving low sulfur fuels or converting sources which burn oil or natural gas to coal. EPA's objective in carrying out the SIP reviews, therefore, has been to try to establish if emissions from combustion sources may be increased. Where an indication can be found that emissions from certain fuel burning sources can be increased and still attain and maintain NAAQS, it may be plausible that fuel resource allocations can be altered for "clean fuel savings" in a manner consistent with both environmental and national energy needs.

In many respects, the ESECA SIP reviews parallel EPA's policy on clean fuels. The Clean Fuels Policy has consisted of reviewing implementation plans with regards to saving low sulfur fuels and, where the primary sulfur dioxide air quality standards were not exceeded, to encourage States to either defer compliance regulations or to revise the SO_2 emission regulations. The States have also been asked to discourage large scale shifts from coal to oil where this could be done without jeopardizing the attainment and maintenance of the NAAQS.

To date, EPA's fuels policy has addressed only those States with the largest clean fuels saving potential. Several of these States have or are currently in the process of revising SO_2 regulations. These States are generally in the Eastern half of the United States. ESECA, however, extends the analysis of potentially over-restrictive regulations to all 55 States and territories. In addition, the current reviews address the attainment and maintenance of all the National Ambient Air Quality Standards.

There are, in general, three predominant reasons for the existence of overly restrictive emission limitations within the State Implementation Plans. These are 1) The use of the example region approach in developing State-wide air quality control strategies; 2) the existence of State Air Quality Standards which are more stringent than NAAQS; and 3) the "hot spots" in only part of an Air Quality Control Region (AQCR) which have been used as the basis for controlling the entire region. Since each of these situations affect many State plans and in some instances conflict with current national energy concerns, a review of the State Implementation Plans is a logical follow-up to EPA's initial appraisal of the SIP's conducted in 1972. At that time SIP's were approved by EPA if they demonstrated the attainment of NAAQS or more stringent state air quality standards. Also, at that time an acceptable method for formulating control strategies was the use of an example region for demonstrating the attainment of the standards.

The example region concept permitted a State to identify the most polluted air quality control region (AQCR) and adopt control regulations which would be adequate to attain the NAAQS in that region. In using an example region, it was assumed that NAAQS would be attained in the other AQCR's of the State if the control regulations were applied to similar sources. The problem with the use of an example region is that it can result in excessive controls, especially in the utilization of clean fuels, for areas of the State where sources would not otherwise contribute to NAAQS violations. For instance, a control strategy based on a particular region or source can result in a regulation requiring 1 percent sulfur oil to be burned state-wide where the use of 3 percent sulfur coal would be adequate to attain NAAQS in some locations.

EPA anticipates that a number of States will use the review findings to assist them in making the decision whether or not to revise portions of their State Implementation Plans. However, it is most important for those States which desire to submit a revised plan to recognize the review's limitations. The findings of this report are by no means conclusive and are neither intended nor adequate to be the sole basis for SIP revisions; they do, however, represent EPA's best judgment and effort in complying with the ESECA requirements. The time and resources which EPA has had to prepare the reports has not permitted the consideration of growth, economics, and control strategy tradeoffs. Also, there has been only limited dispersion modeling data available by which to address individual point source emissions. Where the modeling data for specific sources were found, however, they were used in the analysis.

The data upon which the reports' findings are based is the most currently available to the Federal Government. However, EPA believes that the States possess the best information for developing revised plans. The States have the most up-to-date air quality and emissions data, a better feel for growth, and the fullest understanding for the complex problems facing them in the attainment and maintenance of air quality standards. Therefore, those States desiring to revise a plan are encouraged to verify and, in many instances, expand the modeling and monitoring data supporting EPA's findings. In developing a suitable plan, it is suggested that States select control strategies which place emissions for fuel combustion sources into perspective with all sources of emissions such as smelters or other industrial processes. States are encouraged to consider the overall impact which the potential relaxation of overly restrictive emissions regulations for combustion sources might have on their future control programs. This may include air quality maintenance, prevention of significant deterioration, increased TSP, NO_x, and HC emissions which occur in fuel switching, and other potential air pollution problems such as sulfates .

Although the enclosed analysis has attempted to address the attainment of all the NAAQS, most of the review has focused on total suspended particulate matter (TSP) and sulfur dioxide (SO_2) emissions. This is because stationary fuel combustion sources constitute the greatest source of SO_2 emissions and are a major source of TSP emissions.

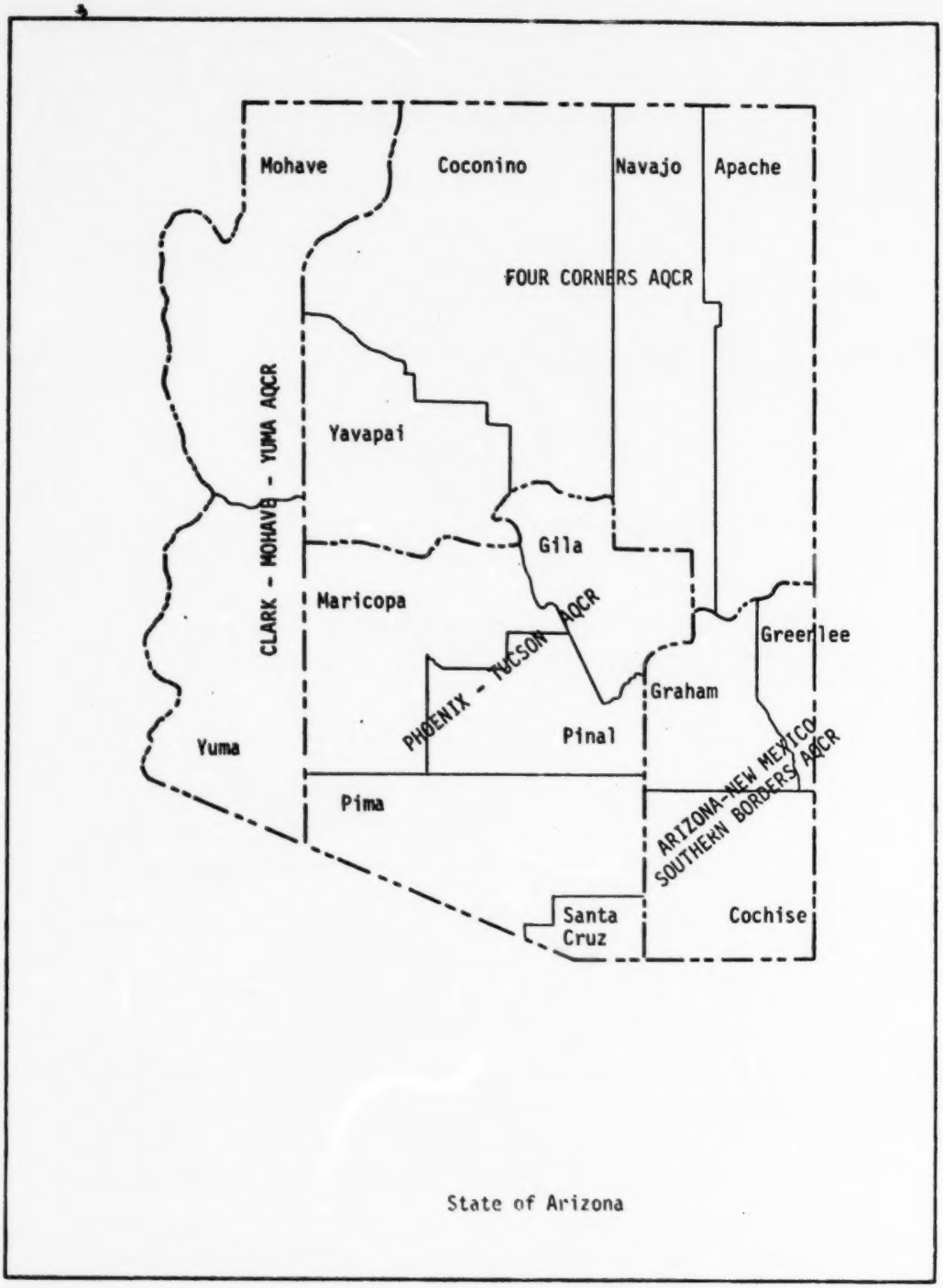
Part of each State's review was organized to provide an analysis of the SO_2 and TSP emission tolerances within each of the various AQCR's. The regional emission tolerance estimate is, in many cases, EPA's only measure of the "over-cleaning" accomplished by a SIP. The tolerance assessments have been combined in Appendix B with other regional air quality "indicators" in an attempt to provide an evaluation of a region's candidacy for changing emission limitation regulations. In conjunction with the regional analysis, a summary of the State's fuel combustion sources (power plants and industrial sources) has been carried out in Appendix C and D.

The State Implementation Plan Review has addressed the emissions from fuel combustion sources in each of Arizona's four Air Quality Control Regions (AQCR's). For your convenience the Arizona AQCR's are shown on the following page. The major findings are as follows:

- The Arizona State Implementation Plan has been reviewed for the most frequent causes of over-restrictive emission limiting regulation. Although Arizona used the Example Region approach in developing control strategies for both TSP and SO_2 and has an annual and 24 hour SO_2 air quality standard more restrictive than NAAQS, there are no indications that current regulations are overly restrictive in the context of Section 4 of ESECA.

- Most of Arizona's particulate emissions originate from wind-blown fugitive dust. In the arid environment, natural background levels are significant and this natural tendency is aggravated by human activity, mainly agriculture, unpaved roads and construction. Such fugitive dust from non-point sources is the primary cause of ambient measurements which exceed national standards. There is currently little possibility, therefore, of revising existing regulations for controlling particulate emissions from stationary fuel combustion sources.

- The majority of SO_2 emissions in the State come from large point sources such as copper smelters (mainly process losses) and power plants. With the exception of the Four Corners AQCR, Arizona is currently developing regulations which are directed towards the control of individual sources. In the Four Corners AQCR, EPA has promulgated emission control for the Navaho Power Plant. However, as these regulations were based upon unvalidated diffusion modeling, EPA is now engaged in a joint air quality test program with Salt River Project to determine more precisely the amount of emission control necessary. It is expected that the State and EPA regulations will be adequate to attain and maintain NAAQS by the required dates, despite current SO_2 violations in three AQCR's (Phoenix - Tucson, Southern Borders and Four Corners). Regulations which are oriented towards specific sources of emissions are consistent with fuel savings and with regards to Section IV of ESECA, Thus, they need no modification.



State of Arizona

2.0 ARIZONA STATE IMPLEMENTATION PLAN REVIEW

2.1 SUMMARY

A revision of fuel combustion source emissions regulations will depend on many factors. For example:

- Does the State have air quality standards which are more stringent than NAAQS?
- Does the State have emission limitation regulations for control of (1) power plants, (2) industrial sources, (3) area sources?
- Did the State use an example region approach for demonstrating the attainment of NAAQS or more stringent State standards?
- Has the State not initiated action to modify combustion source emission regulations for fuel savings; i.e., under the Clean Fuels Policy?
- Are there no proposed Air Quality Maintenance Areas?
- Are there indications of a sufficient number of monitoring sites within a region?
- Is there an expected 1975 attainment date for NAAQS?
- Based on reported (1973) air quality data, does air quality meet NAAQS?
- Based on reported (1973) air quality data, are there indications of a tolerance for increasing emissions?
- Are the total emissions from stationary fuel combustion sources proportionally lower than those of all other sources?
- Is there a significant clean fuels savings potential in the region?
- Must emission regulations be revised to accomplish significant switching?
- Do modeling results for specific fuel combustion sources show a potential for a regulation revision?

The following portion of this report is directed at answering these questions. An AQCR's potential for revising regulations increases when there are affirmative responses to the above.

The initial part of the SIP review report, Section 2 and Appendix A, was organized to provide the background and current situation information for the State Implementation Plan Section 3 and the remaining Appendices provide an AQCR analysis which helps establish the overall potential for revising regulations. Emission tolerance estimates have been combied in Appendix B with other regional air quality "indicators" in an attempt to provide an evaluation of a region's candidacy for revising emission limiting regulations. In conjunction with the regional analysis, a characterization of the State's fuel combustion sources (power plants and industrial sources) has been carried out in Appendix C and D.

Based on an overall evaluation of EPA's current information, AQCR's have been classified as good, marginal, or poor candidates for regulation revisions. The following table summarizes the State Implementation Plan Review. The remaining portion of the report supports this summary with explanations.

STATE IMPLEMENTATION PLAN REVIEW
(SUMMARY)

"INDICATORS"	STATE		Arizona-New Mexico AQCR(#012)		Clark-Mohave-Yuma AQCR (#013)		Four Corners AQCR (#014)		Phoenix-Tucson AQCR (#015)	
	TSP	SO_2	TSP	SO_2	TSP	SO_2	TSP	SO_2	TSP	SO_2
• Does the State have air quality standards which are more stringent than NAAQS?	No	Yes[1]	-	-	-	-	-	-	-	-
• Does the State have emission limiting regulations for control of:										
1. Power plants	Yes	Yes	-	-	-	-	-	-	-	-
2. Industrial sources	Yes	Yes	-	-	-	-	-	-	-	-
3. Area sources	Yes	Yes	-	-	-	-	-	-	-	-
• Did the State use an example region approach for demonstrating the attainment of NAAQS or more stringent State standards?	Yes	Yes	-	-	-	-	-	-	-	-
• Has the State not initiated action to modify combustion source emission regulations for fuel savings; i.e., under the Clean Fuels Policy?	Yes	Yes	-	-	-	-	-	-	-	-
• Are there no proposed Air Quality Maintenance Areas?	-	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
• Are there indications of a sufficient number of monitoring sites within a region?	-	-	N/A	N/A	N/A	No	N/A	No	N/A	N/A
• Is there an expected 1975 attainment date for NAAQS?	-	-	Yes	No	Yes	Yes	Yes	No	No[2]	No
• Based on reported (1973) Air Quality Data, does air quality meet NAAQS?	-	-	No	No	No	Yes[3]	No	Yes[4]	No	No
• Based on reported (1973) Air Quality Data, are there indications of a tolerance for increasing emissions?	-	-	No	No	No	Yes	No	Yes	No	No
• Are the total emissions from stationary fuel combustion sources lower than those of other sources?	-	-	Yes	Yes	Yes	Yes	No	No	Yes	Yes
• Do modeling results for specific fuel combustion sources show a potential for a regulation revision?	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
• Must emission regulations be revised to accomplish significant fuel switching?	-	-	No	No	No	No	No	No	No	No
• Based on the above indicators, what is the potential for revising fuel combustion source emission limiting regulations?	-	-	Poor	Poor	Poor	Marginal	Poor	Poor	Poor	Poor
• Is there a significant Clean Fuels Saving potential in the region?	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

- = not applicable
N/A = not available
1 = only for the annual and 24-hour SO_2 standard
2 = 7/75 for primary standard and 7/77 for secondary standard
3 = no air quality data is available for the Nevada portion of this AQCR
4 = violations are reported in the New Mexico portion of this AQCR

2.2 AIR QUALITY SETTING - STATE OF ARIZONA

The State of Arizona is comprised of four Air Quality Control Regions (see Figure A-1): Phoenix-Tucson Intrastate (#015), Four Corners Interstate (#014), Clark-Mohave-Yuma Interstate (#013) and the Arizona-New Mexico Southern Borders Interstate (#012). Priority classifications for TSP, SO_2 and NO_x in these AQCRs is given in Table A-1. There are no proposed Air Quality Maintenance Area designations for TSP and SO_2.

Table A-4 illustrates both the Federal and State standards for the pollutants under consideration in this project. As can be seen, Arizona has more stringent annual and 24 hour standards for SO_2. A summary of the most currently available air quality data is shown in Table A-5 and A-6. Particulate matter is a major problem in all AQCRs, while violations of the SO_2 standard in Arizona are due to the presence of copper smelters in Phoenix-Tucson and Southern Borders AQCR's.

Emissions of SO_2 and particulate matter are summarized in Tables A-7 and A-8. A large proportion of the particulate emissions in fugitive dust, while SO_2 emissions can be attributed mainly to either power plants or copper smelters.

There are five copper smelters in the Phoenix-Tucson AQCR and two in the Arizona-New Mexico Souther Borders AQCR (Arizona portion). All are on compliance schedules and all are expected to attain standards by 1977. In the interim, all smelters are operating on conditional permits from the State, except Kennecott-Hayden which is essentially in compliance with State SO_2 emission requirements and has already been granted a full operating permit.

All except for two power plants (Navaho and Cholla in the Four Corners AQCR) burn natural gas or oil and are assumed to be attaining standards. These sources have been granted operating permits from either the State or County. There are nine power plants in the Phoenix-Tucson AQCR, one in the Clark-Mohave AQCR, one in the Southern Borders AQCR and two in the Four Corners Region. Cholla (Unit #1) has been granted an operating permit from the State. The Navaho facility is on an EPA compliance schedule with attainment set for 1977.

2.3 BACKGROUND ON THE DEVELOPMENT OF THE CURRENT STATE IMPLEMENTATION PLAN

The State of Arizona adopted an example region approach in writing its implementation plan. The Phoenix-Tucson AQCR was selected for this purpose because: the highest concentrations of pollutants were measured in this region; nearly 81 percent of the population resided in the region; and most types of emission sources found in the State are present in the region. Arizona standards were used in developing control strategies and a proportional rollback model was applied to calculate the emission reductions required.

The Arizona SIP did not provide a SO_2 control strategy adequate to attain national standards. The plan did not set emission limits on copper smelters in the Phoenix-Tucson Intrastate Region and the Arizona portion of the Arizona-New Mexico Southern Borders Interstate Region; nor did the plan provide for adequate control of SO_2 emissions from the Navaho Power Plant in the Four Corners Interstate Region.

On March 23, 1973, EPA promulgated substitute regulations for Navaho (Units 1, 2 and 3) which included SO_2 emission limits based on 70% removal of the sulfur content of local coals. If higher sulfur coal is used, the same emission limit must be met, even though control in excess of 70% might be necessary. The intent of EPA was to promulgate the amount of emission control calculated to be necessary for attainment of the national secondary standard. However, as this calculation was based on unvalidated diffusion modeling, EPA is now engaged in a joint air quality test program with Salt River Project to determine more precisely the amount of emission control necessary for attainment. EPA is committed to the careful consideration of adequate data issuing from the program. There is litigation regarding the Navaho regulations but it may be dismissed as a result of the joint test program.

The State has submitted revised regulations for the control of SO_2 emissions from power plants in the Phoenix-Tucson AQCR. The regulation allows variances for existing power plants if only high sulfur fuel oil (greater than 0.9% sulfur by weight) is available, with the condition that the facility has contingency plans to avert violations of SO_2 standards. EPA will be evaluating this regulation to determine if it is adequate in view of earlier reports from the State that SO_2 standards will be violated in the Phoenix-Tucson area if power plants are to burn oil with a sulfur content between 0.9% and 2.0% (maximum allowable under Arizona regulations).

Regarding particulate matter, the control strategy was disapproved for the Phoenix-Tucson AQCR because it did not provide adequate control for process industries. On May 14, 1973, EPA promulgated the Federal Process Rate Table. All counties within the Phoenix-Tucson AQCR have adopted or soon will adopt EPA's process table, as will the State.

2.3.1 Particulate Control Strategy

Regulations directed towards the control of particulate emissions include: process weight table rate schedule, control of road dust emissions, controls for agricultural practices and tailing piles, and fuel combustion particulate emissions.

2.3.2 SO_2 Control Strategy

The limitation of SO_2 is aimed mainly at discharges from copper smelting process operations and power plants.

2.4 SPECIAL CONSIDERATIONS - STATE OF ARIZONA

The Phoenix-Tucson AQCR is classified Priority I for oxidants. The impact of fuel switching (i.e. natural gas to oil) can only aggravate the oxidant problem, because hydrocarbon emissions from oil combustion are an order of magnitude greater than natural gas combustion (see Table C-2). The similar situation exists for coal combustion hydrocarbon emissions as opposed to oil or natural gas.

The original implementation plan was written assuming that the fuel mix used in 1969 would remain the same in the future. However, due to energy shortages, this assumption is no longer correct. Many states, including Arizona, either have or will experience difficulties in obtaining clean fuels such as natural gas to satisfy all consumer demands. If deliveries of natural gas to oil/gas fired power plants is curtailed (as in the case in many states), these facilities would be forced to switch to fuel oil. Appendix C illustrates the results of a "worse case" switch, assuming that 1) all fuel used is oil and 2) the sulfur content of the oil used is the same as that which is currently being burned. (See Footnote d of Table C-1 for an explanation of how the switching calculation is made) As can be seen, SO_2 emissions would increase by almost a factor of two. The results also show that current SO_2 emission limits will not be violated even with this increase in emissions.

Pursuant to Arizona regulations, SO_2 standards must be achieved in the vicinity of the seven copper smelters by July 1977. These regulations require constant emission reduction to meet the annual standard and allow the use of Supplementary Control Systems [1] (SCS) to meet the 24 - and - 3 hour standards. However, these regulations have not been approved. EPA is currently drafting substitute regulations to be proposed in the near future. The primary difference between State and EPA proposed regulations will revolve around the use of SCS. As noted, State regulations allow permanent use of SCS to attain standards. EPA proposed regulations will allow SCS only under certain circumstances, only after available constant emission control technology is employed, and only on a temporary basis.

Regarding particulate matter, standards are not likely to be attained in any of the Arizona AQCR's. In the arid environment, natural background levels are significant. This natural tendency is aggrevated by human activities, mainly agriculture, unpaved roads and construction. Such fugitive dust from non-point sources is a primary cause of ambient measurements which exceed the national standards. Point sources, including process industries, are adequately controlled.

[1] Supplementary control systems are those which limit pollutant emissions during periods when meteorological conditions are condusive to ground level concentrations in excess of the NAAQS.

3.0 AQCR ASSESSMENTS

3.1 ARIZONA-NEW MEXICO SOUTHERN BORDERS AQCR (#012)

3.1.1 Regional Air Quality Assessment

Both SO_2 and particulates have remained a major problem in this AQCR since the time the original implementation plan submittal (see Tables A-5 and A-6). Particulate emissions are due mainly to fugitive dust, while copper smelters in Morenci and Douglas are the source of over 95% of the SO_2 emissions. (The majority of the SO_2 emissions from smelters is due to process losses, rather than fuel combustion) It has estimated that the SO_2 air quality standards will be achieved by the expected attainment dated (July 1977) through the imposition of stringent controls on the smelters.

Tables B-1 and B-2 present the information which should be considered when estimating the potential for regulation revision. There is no indication that the regulations are overly restrictive.

3.1.2 Power Plant Assessment

There was insufficient fuel use and emission data to carry out an analysis for the one plant in this AQCR (Table C-1).

3.1.3 Industrial/Commercial/Institutional Source Assessments

There are no sources in this category which presently use coal or have the capability of using coal without extensive modifications. An analysis is performed in Table D-1 as to the resulting change in emissions if a fuel switch from natural gas to oil is made. The results indicate that because the majority of the sources in this category currently burn natural gas as their primary fuel, such a switch would increase fuel combustion SO_2 and fuel combustion particulate emissions.

3.1.4 Area Source Assessments

The Arizona-New Mexico Southern Borders AQCR was found to have no area sources which could be analyzed within the content of Section 4 of ESECA.

3.1.5 Fuel Assessments

The only assessment of fuel switching made was in reference to the industrial point sources discussed in Section 3.1.3. The possibility of using higher sulfur content oil than is presently used was not carried out because this AQCR is expected to just marginally attain the SO_2 standard.

3.2 CLARK-MOHAVE-YUMA AQCR (#013)

3.2.1 Regional Air Quality Assessment

Of the two pollutants under consideration, only particulate matter is a problem in the Clark-Mohave-Yuma AQCR (Table A-5). Again, fugitive dust emissions are the main culprit. No violations of the SO_2 standard has occurred, mainly because there is only one small power plant in the Arizona portion of the region. EPA expects little difficulties in maintaining the SO_2 standard. However, the presence of the Mohave Power Plant in the Nevada portion of this AQCR should be noted. If SO_2 controls at Mohave are not adequate, attainment of the standard could be jeopardized in the Arizona portion of this AQCR as well. Controlling TSP in the form of fuitive dust will remain a difficult air pollution situation.

It does not appear that the regulations are over-restrictive.

3.2.2 Power Plant Assessments

There is only one power plant in this region. The Yucca Power Plant in Yuma is a relatively small one (75 Mw) and uses both oil and natural gas. It has no capability of burning coal without extensive modifications. Table C-1 summarizes the pertinent fuel use and emissions data, as well as the effects of a fuel switch to using oil only.

3.2.3 Industrial/Commercial/Institutional Source Assessment

The Clark-Mohave-Yuma AQCR was found to have no sources belonging to this category which could be analyzed within the context of Section 4 of ESECA.

3.2.4 Area Source Assessment

The Clark-Mohave-Yuma AQCR was found to have no area sources which could be evaluated within the context of Section 4 of ESECA.

3.2.5 Fuel Assessments

An analysis has performed on the effect of having the Yucca Power Plant burn only oil (Table C-1). The results indicate a fivefold increase in both SO_2 and particulate emissions as a consequence of this fuel switch. Although the region wide air quality indicates that this increase in SO_2 can be tolerated (i.e. based on proportional rollback), it is highly doubtful that SO_2 standards in the vicinity will not be violated. In addition, the increased particulate emissions can only serve to further aggrevate the currently high particulate levels.

3.3 FOUR CORNERS AQCR (#014)

3.3.1 Regional Air Quality Assessment

At present, only particulate matter is an air quality problem in the Four Corners AQCR (Table A-5). As in the other three AQCRs in Arizona, fugitive dust emissions are the main cause of TSP levels. There have been no reported violations of the SO_2 standards in the Arizona portion of the AQCR. Even with the advent of a 2300 Mw coal fired power plant coming on line near Page, EPA expects the SO_2 standard can be maintained.

There are no indications that the emission limiting regulations for this AQCR are over-restrictive.

3.3.2 Power Plant Assessments

The Cholla Power Plant located near Joseph City is a coal fired 114 Mw unit. Plans are underway to add two new 250 Mw units and EPA is in the process of evaluating their impact. Table C-1 shows the resulting emissions at the present Cholla unit if the maximum permissible sulfur content coal (in terms of lbs $SO_2/10^6$ Btu) is burned. The only other power plant in the AQCR is Navaho, which is also coal fired. With one 750 Mw unit presently on line and two more 750 Mw units scheduled to do so in the near future, Navaho has already generated considerable controversy as to the degree of control required such that national SO_2 standards are not violated. The EPA promulgated 70% control regulation (39 FR 176, September 10, 1974) has been disputed in court by the Salt River Project. The most recent action in the controversy was the initiation of a joint air quality monitoring study to determine the actual degree of control required.

3.3.3 Industrial/Commercial/Institutional Source Assessments

The Four Corners AQCR was found to have no sources in this category which could be evaluated within the context of Section 4 of ESECA.

It should be noted that two companies, U.S. Lime and Phoenix Cement, are in the process of converting to coal.

3.3.4 Area Source Assessment

The Four Corners AQCR was found to have no area sources which could be evaluated within the context of Section 4 of ESECA.

3.3.5 Fuel Assessments

The analysis of fuel switching was carried out only for the Cholla Power Plant (Table C-1). The evaluation was made in terms of increasing the sulfur content of the coal used (in terms of 10^6 Btu/lb) up to the state emission limits.

3.4 PHOENIX-TUCSON AQCR (#015)

3.4.1 Regional Air Quality Assessment

The most currently available air quality data indicated frequent violations of both the SO_2 and particulate standard (Tables A-5 and A-6). SO_2 emissions are attributed mainly to either copper smelters or power plants, while particulates emissions emanate from fugitive dust and process losses. EPA estimates that when all smelters are brought into compliance (July 1977), the SO_2 standards will be attained. These SO_2 emissions are primarily the result of sulfur released from the copper during the smelting process; very little of the total SO_2 emissions from smelters are the result of sulfur in the combustion fuel.

There are no indications that the regulations are over-restrictive.

3.4.2 Power Plant Analysis

There are more power plants in the Phoenix-Tucson AQCR than in all the other three Arizona AQCRs combined. Every one of these plants is oil and gas fired, with no capability of using coal without extensive modifications. Table C-1 illustrates the results of fuel switching (i.e. burning oil only) at these plants.

3.4.3 Industrial/Commercial/Institutional Source Assessments

Only two industrial sources are found to deserve analysis (Table D-1). (One additional company, Arizona Portland Cement, is in the process of converting to coal). As was the case in the other three AQCRs, an evaluation of the effects of fuel switching was made. The results indicate that SO_2 and particulate emissions would increase by a factor of twelve.

3.4.4 Area Source Assessment

The Phoenix-Tucson AQCR was found to contain no area sources which could be evaluated within the context of Section 4 of ESECA.

3.4.5 Fuel Assessments

The consequences of a fuel switch in the Phoenix-Tucson AQCR are shown in Table C-1: SO_2 emissions will increase by over 17,000 tons/year and particulate emission by over 1700 tons/years.

APPENDIX A

- State implementation plan information
- Current air qualtty information
- Current emissions information

Tables in this appendix summarize original and modified state implementation plan information, including original priority classifications, attainment dates, ambient air quality standards, and fuel combustion emission regulations. SAROAD data for SO_2 and TSP monitoring stations are shown for AQCRs in the state. NEDS emissions data by AQCR[1] are tabulated and broken down into fuel burning categories.

Tables A-10 and A-11 show a comparison of emission inventories in the original SIP and those from the NEDS. An emission tolerance, or emission tonnage which might be allowed in the AQCR and still not violate national secondary ambient air quality standards, is shown for SO_2 and particulates. Tolerance was based on either the degree of control expected by the SIP or upon air quality/emission relationships which are calculated from more recent data. The value of the emission tolerance provides an indication of the degree of potential an AQCR possesses for fuel revisions and regulation relaxation.

Methodology for Increased Emissions Tolerance

A tolerance for increased emissions was determined as follows. First, an "allowable emissions" was calculated for each AQCR based on the current NEDS data and the percent reduction (or increase) required to meet the national secondary ambient air quality standards in that AQCR (worst case from Tables A-5 and A-6). This "allowable" was then compared to that from the SIP. If reasonable agreement occurred, then the "estimated emissions" which would result after implementation of the SIP in that AQCR was used to calculate an emissions tolerance. Thus, some credit could be given to an AQCR which might be restricting emissions more than required by ambient air quality standards. For instance, emission controls applied to AQCRs

[1] "1972 National Emissions Report," EPA - 450/2-74-012, June 1974.

for the state may reduce emissions well below "allowables." In the event that no data existed or was available from the SIP for an AQCR, the current air quality was used to [illegible] emissions tolerance based on proportional rollback or rollup. Current air quality was also the criteria, if emissions data from SIP and NEDS did not appear to be comparable (this is often the case).

When no SIP emissions data was available, and current air quality levels were less than one half of the level represented by an ambient air quality standard, no "rollup" emissions tolerance was calculated in Tables A-10a and A-10b. This arbitrary cutoff point was chosen so as not to distort the emissions tolerance for an area. At low levels of a pollutant, the relationship between emissions and air quality is probably not linear.[1] Although this cutoff may leave some AQCRs with no quantifiable emissions tolerance, it was felt that no number at all would be preferable to a bad or misleading number.

It is emphasized that emissions tolerance is a region-wide calculation. This tolerance obviously makes more sense in, say, an urban AQCR with many closely spaced emissions sources than in a largely rural AQCR with geographically dispursed emissions.

[1] Low concentrations of pollutants probably indicate a low density of sources and that the air quality monitors are not located near the sources. Thus changes in emissions from the sources will not result in a linear change in air quality readings.

Table A-1. Arizona Air Pollution Control Areas

Air Quality Control Region	Federal Number	Priority Classification[a]			Proposed AQMA Designations[b]	
		Particulate	SO_x	NO_x	TSP Counties	SO_x Counties
Arizona - New Mexico Southern Border[c]	012	IA	IA	III	(0)	(0)
Clark-Mohave[c]	013	I	I	III	(0)	(0)
Four Corners[c]	014	IA	IA	III	(0)	(0)
Phoenix-Tucson	015	I	I	III	(0)	(0)

Priority	I	II	III
	Greater than	From-to	Less-than
Sulfur oxide			
Annual Arithematic mean	100	60-100	60
24 hour maximum	455	260-455	260
Particulate matter			
Annual geometric mean	95	60-95	60
24 hour maximum	325	150-325	150

[a]Criteria based on maximum measured (or estimated) pollution concentration ($\mu g/m^3$) in area.
[b]Federal Register, August 1974, SMSA's showing potential for NAAQS violations due to growth.
[c]Interstate AQCR.

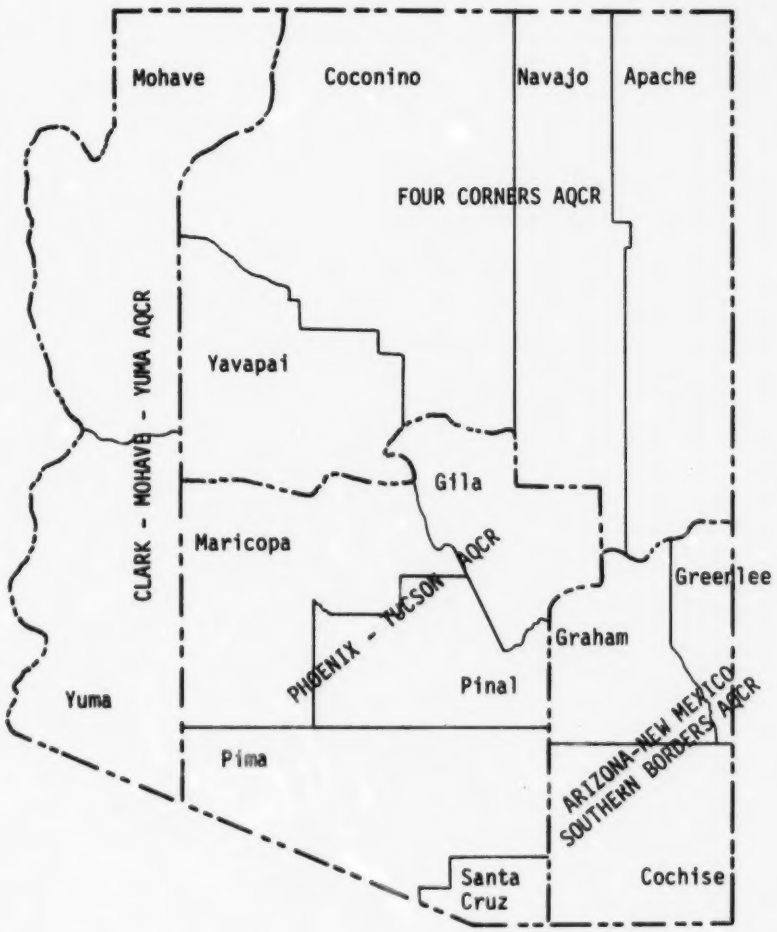


Figure A-1 State of Arizona

Table A-2. Arizona Population and Area

AQCR	County	Area (Square miles)	Population	Population Density (per square mile)
Arizona - New Mexico Southern Borders[a]	Cochise	6256	61918	9.9
	Graham	4618	16578	3.6
	Greenlee	1879	10330	5.5
Clark - Mohave - Yuma[a]	Mohave	13217	25857	2.0
	Yuma	9983	60827	6.1
Four Corners[a]	Apache	11171	32304	2.9
	Coconino	18540	48326	2.6
	Navajo	9910	47559	4.8
	Yavapai	8091	37005	4.6
Phoenix-Tucson	Gila	4748	29255	6.2
	Maricopa	9155	968487	105.8
	Puma	9240	351667	38.1
	Pinal	5364	68579	12.8
	Santa Cruz	1246	13966	11.2

[a]Interstate - counties listed are those in Arizona only.

Table A-3. Attainment Dates

AQCR	Name	Particulate Attainment Dates Primary	Particulate Attainment Dates Secondary	Sulfur Oxides Attainment Dates Primary	Sulfur Oxides Attainment Dates Secondary	Nitrogen Oxides Attainment Dates
012[a]	Arizona - New Mexico Southern Borders	7/75[e]	7/75[e]	7/77	7/77	d
013[b]	Clark - Mohave - Yuma	7/75[e]	7/75[e]	7/75	7/75	d
014[c]	Four Corners	7/75[e]	7/75[e]	7/77	7/77	d
015	Phoenix - Tucson	7/75[e]	7/77[e]	7/77	7/77	d

[a]Interstate with New Mexico

[b]Interstate with Nevada

[c]Interstate with Utah, Colorado and New Mexico

[d]Air quality levels presently below standards.

[e]It is unlikely that the standards will be attained by the required dates. See Section 2.4.

Table A-4. Arizona Ambient Air Quality Standards

		All Concentrations in $\mu g/m^3$					
		Total Suspended Particulates		Sulfur Oxides			Nitrogen Dioxide
		Annual	24-hour	Annual	24-hour	3-hour	Annual
Federal	Primary	75 (G)	260[a]	80 (A)	365[a]	-	100 (A)
	Secondary	60 (G)	150[a]	-	-	1300[a]	100 (A)
Arizona		60 (G)	150	50 (A)	260	1300	100 (A)

[a]Not to be exceeded more than one time a year.

(A) Arithemetic mean

(G) Geometric mean.

Table A-5. Arizona AQCR Air Quality Status (1973), TSP[a]

AQCR Name	State	# Stations Reporting	TSP Concentration ($\mu g/m^3$) Highest Reading Annual	Highest Reading 24-Hr	2nd Highest Reading 24-Hr	# Stations Exceeding Ambient Air Quality Standards Primary Annual	Primary 24-Hr[c]	Secondary Annual	Secondary %	Secondary 24-Hr[c]	Secondary %	% Reduction Required to Meet Standards[d]	Standard on Which Reduction Is Based
Arizona - New Mexico Southern Border[b]	Arizona	3	N/A	475	215	0	0	N/A	N/A	2	50	30	24 hr
	New Mex.	10	72	523	395	0	2	1	10	6	60	62	24 hr
Clark - Mohave - Yuma[b]	Arizona	5	109	1101	287	1	1	1	20	1	20	59	Annual
	Nevada	16	177	850	792	6	3	8	47	9	53	81	24 hr
Four Corners[b]	Arizona	7	58	430	375	0	1	0	0	3	43	60	24 hr
	New Mex.	6	65	234	228	0	0	1	17	1	17	34	24 hr
	Utah	2	15	254	186	0	0	0	0	1	50	19	24 hr
	Colorado	8	N/A	116	104	N/A	0	N/A	N/A	0	0	-44	24 hr
Phoenix - Tucson	Arizona	32	215	1005	777	7	6	10	29	26	76	82	Annual

[a] 1973 air quality data in National Air Data Bank as of June 7, 1974.

[b] Interstate.

[c] Violation based on more than one excess of the standard.

[d] Calculate from: $\frac{\text{2nd Highest 24 Hr Reading - 24 Hr Secondary Standard}}{\text{2nd Highest 24 Hr Reading}}$ or $\frac{\text{Annual Reading - Annual Secondary Standard}}{\text{Annual Reading - Background}}$

Note: 24 hour background assumed to be zero for all states.

Annual background: Arizona = 26 $\mu g/m^3$
Colorado = 30 $\mu g/m^3$
New Mexico = 17 $\mu g/m^3$
Utah = 18.8 $\mu g/m^3$

N/A = Not available.

Table A-6. Arizona AQCR Air Quality Status (1973), SO_2[a]

AQCR Name	State	# Stations Reporting 24-Hr (Bubbler)	# Stations Reporting (Contin.)	SO_2 Concentration ($\mu g/m^3$) Highest Reading Annual	Highest Reading 24-Hr	2nd Highest Reading[c] 24-Hr	# Stations Exceeding Ambient Air Quality Stds. Primary Annual	Primary 24-Hr[d]	Secondary 3-Hr[d]	% Reduction[e] Required To Meet Standards	Standard on Which % Reduction Is Based
Arizona - New Mexico Southern Border[b]	Arizona	7	7	86	3510	2335	1	6	6	84	24 hr
	New Mex.	10	2	137	1294	1032	1	3	2	65	24 hr
Clark - Mohave - Yuma[b]	Arizona	1	0	3	10	2	0	0	N/A	f	N/A
	Nevada	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Four Corners[b]	Arizona	2	0	2	9	9	0	0	N/A	f	N/A
	New Mex.	7	4	N/A	79	N/A	0	0	0	f	N/A
	Utah	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Colorado	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Phoenix - Tucson	Arizona	17	12	219	2373	2319	1	7	8	84	24 hr

[a] 1973 air quality data in National Air Data Bank - June 7, 1974

[b] Interstate

[c] The 2nd highest readings were only given at 24 hr stations and not continuous stations. The values reported in this column are from 24 hr stations and may not be the true 2nd highest reading (since the 2nd highest reading from continuous stations may be larger in value).

[d] Violations based on more than one excess of standard.

[e] Calculated from: $\frac{\text{2nd Highest 24 Hr Reading - National Secondary 24 Hr Standard}}{\text{2nd Highest 24 Hr Reading}}$ or $\frac{\text{Annual Reading - Secondary Ann'l Std.}}{\text{Annual Reading}}$

[f] Reductions were not calculated because the annual and 24 hr readings are less than 1/2 of the corresponding standard. It was decided in this case that calculating reductions would yield misleading figures.

Note: Background assumed to equal zero for both annual and 24 hr concentrations.

N/A = Not available.

Table A-7. Arizona Fuel Combustion Source Summary

AQCR	Arizona Power Plants[b]	Other Arizona Fuel Combustion Point Sources[c]	Total Arizona Fuel Combustion Emissions (10^3 tons/year)[d]	
			Particulates	SO_2
Arizona - New Mexico - Southern Borders[a]	1	3	.163	.282
Clark - Mohave - Yuma[a]	1	0	.064	.051
Four Corners[a]	2	0	7.9	3.6
Phoenix - Tucson	9	8	1.97	3.06

[a]Interstate.

[b]From Arizona SIP.

[c]From NEDS rank order.

[d]Emissions in data bank as of June 27, 1974.

Table A-8. Arizona Emissions Summary, Particulate[a]

AQCR	State	Total Particulates (tons/year)	Electrical Generation		Industrial, Institutional, Commercial Point Source Fuel Combustion		Area Source Fuel Combustion		Other Sources Particulate Emissions	
			tons/yr	% of total	tons/yr	% of total	tons/yr	% of total	tons/yr	% of total
Arizona - New Mexico -So. Borders[b]	Arizona	19,900	44	0.2	55	0.3	64	0.3	19,741	99.2
	New Mex.	3,400	17	0.5	104	3.1	43	1.3	3,233	95.1
Clark - Mohave Yuma[b]	Arizona	1,300	15	1.2	0	0	49	3.8	1,235	95
	Nevada	63,130	8,486	13.4	28	0.04	340	0.5	54,292	86
Four Corners[b]	Arizona	9,700	6,900	70	0	0	1,000	10.3	1,730	18.7
	New Mexico	24,600	20,295	82.5	66	0.3	200	0.8	4,034	16.4
	Utah	1,800	73	4.1	0	0	714	40	1,006	55.9
	Colorado	1,560	0	0	29	18.5	463	30	803	51.5
Phoenix - Tucson	Arizona	49,200	564	1.1	75	0.1	1,300	2.6	47,290	96.2

[a] 1972 Emissions in data bank as of June 27, 1974.

[b] Interstate.

Table A-9. Arizona Emission Summary, SO_2[a]

AQCR	State	Total SO_2 (tons/year)	Electrical Generation tons/yr	Electrical Generation % of total	Industrial, Institutional, Commercial Point Source Fuel Combustion tons/yr	Industrial, Institutional, Commercial Point Source Fuel Combustion % of total	Area Source Fuel Combustion tons/yr	Area Source Fuel Combustion % of total	Other Sources of SO_2 Emissions tons/yr	Other Sources of SO_2 Emissions % of total
Arizona - New Mexico So. Borders[b]	Arizona	947,000	2	.0002	206	0.02	66.0	0.007	946,726	99.9
	New Mex.	247,454	1	0	116	0.05	24	0	247,313	99.95
Clark - Mohave Yuma[b]	Arizona	594	1	0.2	0	0	50.0	8.4	543	91.4
	Nevada	57,000	54,900	96	1	0	726	1.3	1,539	2.7
Four Corners[b]	Arizona	4,300	3,400	79	0	0	206	4.7	746	16.3
	New Mexico	113,264	107,374	95	175	0.2	31	0.03	5,403	4.77
	Utah	119,756	110,854	93	175	0.1	1,315	1.1	6,946	5.8
	Coloardo	440	0	0	2	0.5	324	73.6	114	25.9
Phoenix - Tucson	Arizona	899,232	473	0.06	189	0.02	2,400	0.27	896,123	99.7

[a]1972 Emissions in data bank as of June 27, 1974.

[b]Interstate.

Table A-10. Arizona Required Emission Reductions, Particulate

AQCR	SIP: AQ Measurement Control Value	SIP: Emissions (10^3 tons)	SIP: Allowable Emissions (10^3 tons)	SIP: 1975 Estimated Emissions After Controls (10^3 tons)	Percent Reduction Required Based On 1973 AQ Data	NEDS Emissions (10^3 tons)	Allowable Emissions (10^3 tons)	Emission Tolerance (10^3 tons)
Ariz, N.Mex So.Bord.[a]	240 $\mu g/m^3$ [c,f]	63.8[d]	10.2[d,e]	N/A	30[f]	19.9[f]	13.9[d,e]	-6.0
Clark-Mohave-Yuma[a]	144 $\mu g/m^3$ [b,f]	48.9[d]	51.3[d,e]	N/A	59[f]	1.3[d]	0.5[d,e]	-0.8
Four Corners[a]	15.2 $\mu g/m^3$ [c,f]	113.2[d]	g	N/A	60[f]	9.7[d]	3.9[d,e]	-5.8
Phoenix-Tucson	265 $\mu g/m^3$ [c]	123.8	17.3[e]	44.3	82[c]	49.2	8.9[e]	-40.3

[a] Interstate

[b] 24 hour average

[c] Annual geometric mean

[d] Emissions from Arizona portion of interstate AQCR

[e] Emissions required to meet national secondary standards

[f] Based on air quality data in Arizona portion of interstate AQCR

[g] Allowable emissions were not calculated because air quality is less than one-half the standard.

N/A = not available

Table A-11. Arizona Required Emission Reductions, SO_2

	SIP							
AQCR	AQ Measurement Control Value	Emissions (10^3 tons)	Allowable Emissions (10^3 tons)	1975 Estimated Emissions After Controls (10^3 tons)	Percent Reduction Required Based On 1973 AQ Data	NEDS Emissions (10^3 tons)	Allowable Emissions (10^3 tons)	Emission Tolerance (10^3 tons)
012[a]	1717 $\mu g/m^3$ [b,f]	853.1[c]	179[c,d]	N/A	84[b,f]	947[c]	152[c,d]	-795
013[a]	N/A	.9[c]	N/A	N/A	e	0.6[c]	e	e
014[a]	54.6 $\mu g/m^3$ [b,f]	6.9[c]	g	N/A	e	4.3[c]	e	e
015	4550 $\mu g/m^3$ [b]	1029.8	56.6[d]	N/A	84[b]	889	142[d]	-747

[a] Interstate

[b] 24 hour average

[c] Emissions based on Arizona portion of interstate AQCR

[d] Emissions required to meet national secondary standards

[e] Present air quality is less than one-half the standard. Emission tolerances were not calculated in this case because it was felt that the results would be misleading.

[f] Air Quality in Arizona portion of interstate AQCR

[g] Air quality was less than one-half the standard. Allowable emissions were not calculated in this case because it was felt that the results would be misleading.

Table A-12. Arizona Fuel Combustion Regulations[a]

Sulfur Oxides

A. Steam power generating installations which are new sources shall not emit more than 0.80 lbs of SO_2, maximum two hour average, per million Btu heat input when oil is fired. Steam power generating installations which are existing sources shall not emit more than 1.0 lbs of SO_2, maximum two hour average, per million Btu heat input when low sulfur oil is fired.

B. Steam power generating installations which are existing sources shall not emit more than 2.2 lbs of SO_2, maximum two hour average, per million Btu heat input when high sulfur oil is fired.

C. For purposes of this regulation, low sulfur oil means fuel oil containing 0.90 percent or more by weight of sulfur.

D. Steam power generating installations which are new sources shall not emit more than 0.80 lbs of SO_2, maximum two hour average, per million Btu heat input when coal is fired. Steam power generating installations which are existing sources shall not emit more than 1.0 lbs of SO_2, maximum two hour average, per million Btu heat input when coal is fired.

E. Any permit issued for the operation of an existing source, or any renewal or modification of such a permit, shall include a condition prohibiting theuse of high sulfur oil by the permittee, except that if the applicant demonstrates to the satisfaction of the director: (1) That sufficient quantities of low sulfur oil are not available for use by the source, and (2) that it has adequate facilities and contingency plans to ensure that the sulfur dioxide ambient air quality standards set forth in Regulation 7-1-2.2 will not be violated. The terms of the permit may authorize the use of high sulfur oil under such conditions as are justified. In cases where the permittee is authorized to use high sulfur oil it shall submit to the department monthly reports detailing its efforts to obtain low sulfur oil. When the conditions justifying the use of high sulfur oil no longer exist, the permit shall be modified accordingly.

Table A-12. Arizona Fuel Combustion Regulations[a] (Contd)

Particulate Matter

Particulate matter emissions from fuel combustion sources are restricted by the following table:

Heat Input (10^6 Btu/hr)	Lbs/hr (24 hour arithmetic average)
10	0.599
50	0.413
100	0.352
500	0.243
1000	0.207
4000	0.153
8000	0.103
10,000	0.0909
20,000	0.0613
40,000	0.0414
50,000	0.0364
100,000	0.0246

For heat inputs not given above, use the following formulas:

10×10^6 Btu/hr < Heat Input < 4000×10^6 Btu/hr $\quad y = 1.02 \times^{-0.231}$

4000×10^6 Btu/hr < Heat Input $\quad y = 17 \times^{-0.568}$

where y = lbs/hr of particulate matter
x = equipment capacity rate (10^6 Btu/hr)

[a]From: Semi Annual Report (SIP) for Arizona (January-June 1974)

APPENDIX B

Tables B-1 and B-2 are the assessment of AQCRs which should be examined for the fuel switching impact on particulate and SO_2 emissions. They also provide an identification of those AQCRs which show little potential for fuel revision or regulation relaxation if ambient air standards are to be attained.

The criteria for candidates are (1) the severity and breadth of air quality violations, (2) the tolerance for emissions increased in the AQCR, (3) the fraction of total emissions resulting from fuel combustion, and (4) AQMA designations. It should be noted that an AQCR may not necessarily need relaxation of regulations in order to accomplish fuel switching. Further, a good candidate in Tables B-1 and B-2 may later show little potential for fuel switching after individual sources are examined. Finally it is possible that an AQCR may have air quality levels below standard at present and may require more <u>strict</u> regulations than currently exist if all fuel burning sources were converted to dirtier fuels, i.e., "average" emission rate now may be below "average" regulations.

Table B-1. Arizona Candidacy Assessment for Revision of Particulate Regulations

AQCR	# of Stations	# of Stations Rpt'g Violations of Nat'l Secondary Standard		Expected Attainment Date	Counties with Proposed AQMA Designation for Particulates?	1972 Total Emissions (tons/year)	% Emissions from Fuel Combustion	Tolerance for Emission Increase in 1975 (tons/yr)	Regionwide Evaluation
		Annual	24 Hour						
Arizona-New Mexico Southern Border[a]	13	1	8	7/75	No	19,900[b]	0.8[b]	-6000	Poor Candidate
Clark-Mohave-Yuma[a]	21	9	10	7/75	No	1,300[b]	5	- 800	Poor Candidate
Four Corners[a]	23	1	5	7/75	No	9.700[b]	81.3[b]	-5800	Poor Candidate
Phoenix-Tucson	32	10	26	7/77	No	49,200	3.8	-40,300	Poor Candidate

[a]Interstate

[b]Arizona portion of interstate AQCR

Table B-2. Arizona Candidacy Assessment for Revision of SO_2 Regulations

AQCR	Air Quality Summary: # of Stations	# of Stations Rpt'g Violations of Nat'l Standard: Secondary Annual	# of Stations Rpt'g Violations of Nat'l Standard: 24 Hour	Expected Attainment Date	Counties with Proposed AQMA Designation for SO_2?	1972 Total Emissions (tons/year)	% Emissions from Fuel Combustion	Tolerance for Emissions Increase in 1975 (tons/yr)	Regionwide Evaluation
Arizona-New Mex. Southern Border[a]	17	2	9	7/77	No	947,000[b]	2.7[b]	-795,000	Poor Candidate
Clark-Mohave-Yuma[a]	1	0	0	7/75	No	594[b]	8.6[b]	c	Marginal Candidate
Four Corners[a]	9	0	1	7/77	No	4300[b]	83.7[b]	c	Poor Candidate
Phoenix-Tucson	17	1	7	7/77	No	889,000	0.3	-747,000	Poor Candidate

[a] Interstate.

[b] Arizona portion of interstate AQCR.

[c] Not calculated, see Table A-11 for explanation.

APPENDIX C

This section is a review of individual power plants by AQCR. The intent is to illustrate fuel switching possibilities and particulate and SO_2 emissions resulting from these switches on an individual plant basis.

Current power plant information used to prepare Table C-1 was obtained from three main sources: (1) Federal Power Commission computerized listings of power plants and their associated fuel use, (2) the National Coal Association "Steam Tables" listing of power plants and fuel use in 1972, and (3) NEDS Emissions data.[1] For those plants listed by the FPC (1 above), the 1973 fuel schedule was assumed, otherwise, fuel use is for 1972. Heat inputs are those based on actual fuel values where known, and average values shown in Table C-2 were used where not known. SO_2 and particulates emissions are those associated with the fuel use shown. In the case of particulates, emissions were calculated using NEDS emissions factors applied to the listed fuel schedule (in both tonnage and lbs/10^6 Btu). When a plant was not listed in NEDS, AP-42 emission factors were used to estimate SO_2 and TSP emissions (see Table C-2).

For the purposes here, it is assumed that when a plant is shown to have dual fuel capability, it is able to use entirely one fuel or the other. A fuel switch calculation is then made, assuming all natural gas use is replaced by either oil or coal depending on assumed plant capabilities. Further, oil use is replaced by coal where possible. The % sulfur in fuel (coal or oil) assumed when fuels are switched is indicated in Table C-1. A plant was then assumed to have the same emission controls as was in effect when the NEDS emissions were assembled. The resulting emissions which would then accompany such fuel switches are tabulated in both tonnage and lbs/10^6 Btu.

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[1] NEDS Data Bank 1974.

Also shown is the 1975 regulations which are currently applicable to the given plant, taken from Table A-12. (Particulate limits are assumed to be based on the entire heat input of the plant. Actual rules may be different when applied to each of several boilers in a power plant or applied on the basis of design capacity rather than actual amount of fuel used.)

The fuel switch calculations are intended to show the magnitude of emissions increase accompanying a fuel switch without additional controls. The exact emissions would depend upon actual fuel mix, amount of sulfur in fuels, and degree of emissions controls (particulates).

It might be cautioned that AQCR total emissions calculated in the tables of Appendix C may not agree exactly with total emissions represented in Appendix A (Tables A-8, A-9). This is a result of both differing fuel schedules in 1973 compared to previous years and the relative "completeness" of the NEDS data bank.

Table C-1. Arizona Power Plant Analysis

AQCR	Plant	Capacity	Fuel Use[a] Type, % Sulfur, % Ash	Annual Quantity	Heat Input (10^6 Btu/hr)	Emissions[b] (tons/Yr) SO_2	Part.	(lbs/10^6 Btu) SO_2	Part.	1975 Emission Limit (lbs/10^6 Btu) SO_2	Part.	Assumed % S	Emissions after Fuel Switching[c] tons/year SO_2	Part.	lbs/10^6 Btu SO_2	Part.
Arizona - New Mexico Southern Border	Douglas	20 Mw	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-
Clark - Mohave - Yuma	Yucca	75 Mw	Oil 0.99%S	4410 x 10^3 gal	70.4	339	17.6	1.1	.057	2.2	0.215	0.99	1738	90.1	1.09	0.06
			Gas	2548 x 10^6 ft^3	290	0.8	19.1									
Four Corners	Cholla	114 Mw	Coal 0.44%S	452 x 10^3 tons	1066	3860	N/A	0.83	N/A	1.0	0.342	0.44	4651	N/A	0.99	N/A
	Navaho (under const'n)	2250 Mw	Coal	N/A	N/A	N/A	N/A	N/A	N/A	0.8	0.111	-	-	-	-	-
Phoenix - Tucson	Ocotillo	227 Mw	Oil 0.81%S	36036 x 10^3 gal	575	2265	144	0.89	.057	1	0.235	0.81	4664	296	0.86	0.06
			Gas	5342 x 10^6 ft^3	609	2	40									
	Phoenix	110 Mw	Oil 0.7%S	6006 x 10^3 gal	96	325	24	0.77	.057	1	.213	0.7	796	59	0.77	0.06
			Gas	1218 x 10^6 ft^3	139	0.4	9.1									
	Saguaro	250 Mw	Oil 0.7%S	42714 x 10^3 gal	681	2321	171	0.77	.057	1	0.126	0.7	3988	294	0.77	0.06
			Gas	4288 x 10^3 ft^3	489	1.3	32									
	Agua Fria	390 Mw	Oil 0.63%S	105504 x 10^3 gal	1683	5159	422	0.7	.059	1	0.212	0.63	8276	677	0.69	0.06
			Gas	8923 x 10^6 ft^3	1017	2.7	67									

Table C-1. Arizona Power Plant Analysis (Continued)

AQCR	Plant	Capacity	Fuel Use[a] Type, % Sulfur, % Ash	Annual Quantity	Heat Input (10^6 Btu/hr)	Emissions[b] (tons/Yr) SO_2	Part.	(lbs/10^6 Btu) SO_2	Part.	1975 Emission Limit (lbs/10^6 Btu) SO_2	Part.	% Sulfur Assumed	Emissions after Fuel Switching[c] tons/year SO_2	Part.	lbs/10^6 Btu SO_2	Part.
Phoenix - Tucson	Cross Cut	30 Mw	Oil 0.77%S	857 x 10^3 gal	13.7	51	3.4	0.85	.056	1	0.339	0.77	298	27	0.85	0.06
			Gas	813 x 10^6 ft^3	93.3	0.2	6.1									
	Kyrene	108 Mw	Oil 0.75%S	24276 x 10^3 gal	387	1414	97	0.83	.057	1	0.213	0.75	2598	178	0.83	0.06
			Gas	2844 x 10^6 ft	324	0.9	21.3									
	Demoss Petrie	105 Mw	Oil 0.73%S	10626 x 10^3 gal	170	601	42.5	0.81	.057	1	0.218	0.73	2308	163	0.81	0.06
			Gas	4220 x 10^6 ft^3	481	1.3	31.7									
	Irvington	505 Mw	Oil 0.6%S	107352 x 10^3 gal	1713	4993	429	0.67	.057	1	0.182	0.6	9196	790		0.06
			Gas	23647 x 10^6 ft^3	1442	3.8	95									
	North Loop	75 Mw	Oil 0.4%S	2728 x 10^3 gal	46	77[c]	12[c]	0.38	.059	1	N/A	0.4	82	13	0.38	0.06
			Gas	24 x 10^6 ft^3	2.9	0	0									

Table C-1. Arizona Power Plant Analysis (Continued)

[a]1973 data from Federal Power Commission except for North Loop, where data is for 1972 and is from NEDS. Heat content of natural gas assumed to be 1000 Btu/ft^3; for oil, 140,000 Btu/gallon

[b]For emissions from oil:

- SO_2 - 1973 data from FPC.
- Particulates - applying EPA emission factors (AP-42) to 1973 fuel use data.

For emissions from natural gas:

- SO_2 and particulates - applying EPA emission factors (AP-42) to 1973 fuel use data.

[c]1972 data from NEDS

[d]For power plants burning both oil and natural gas in 1973: Convert the amount of natural gas used to an equivalent quantity of oil with the same sulfur content as used in 1973. Increase the SO_2 and particulate emissions by direct proportioning assuming all fuel used is oil.

Example: Yucca Power Plant in Clark - Mohave - Yuma AQCR

(1) Amount of natural gas used = 2548×10^6 ft^3

(2) 2548×10^6 $ft^3 \times 1000$ Btu/ft^3 = 2548×10^9 Btu.

(3) $\frac{2548 \times 10^9 \text{ Btu}}{1.4 \times 10^5 \text{ Btu/gal oil}} = 18{,}200 \times 10^3$ gallons of "equivalent" oil.

(4) Total oil used = $4410 \times 10^3 + 18{,}200 \times 10^3 = 22{,}610 \times 10^3$ gallons.

(5) New SO_2 emissions = $\frac{22{,}610 \times 10^3 \text{ gallons}}{4410 \times 10^3 \text{ gallons}} \times 339$ tons/yr = 1738 tons/yr of SO_2.

For power plants burning coal in 1973: Increase 1973 emissions by the factor $\frac{\text{1975 Emission Limit (lbs/}10^6\text{ Btu)}}{\text{1973 Emissions (lbs/}10^6\text{ Btu)}}$

Table C-2. AP-42 Power Generation Emission Factors

Fuel	Particulates		SO_2		Hydrocarbons		NO_x (as NO_2)	
	Lbs/Ton	Lbs/10^6 Btu	Lbs/Ton	Lbs/10^6 Btu	Lbs/Ton	Lbs/10^6 Btu	Lbs/Ton	Lbs/10^6 Btu
Coal[1] (Bit.)								
General	160	7.4			0.3	0.013	18	0.78
Wetbottom 10% A	130	7.0					30	1.3
Cyclone	20	0.9					55	2.4
1% S	Same	Same	38	1.65	0.3	0.13	Same	Same
2% S	as	as	76	3.3			as	as
3% S	Above	Above	114	5.0			Above	Above
Oil[2]	Lb/10^3 Gal		Lb/10^3 Gal		Lb/10^3 Gal		Lb/10^3 Gal	
0.5% S	8	0.058	79	0.56	2	.014	105	0.75
1.0% S	8	.058	157	1.12	2	.014	105	0.75
2.0% S	8	.058	314	2.24	2	.014	105	0.75
Gas[3]	Lb/10^6Ft^3		Lb/10^6Ft^3		Lb/10^6Ft^3		Lb/10^6Ft^3	
(.3 lbs S/ 10^6 Ft^3)	15	.015	0.57	.00057	1	.001	600	0.60

(1) Coal 23 x 10^6 Btu/Ton

(2) Oil 140 x 10^3 Btu/Gal

(3) Gas 1000 Btu/Ft^3

APPENDIX D

Table D-1 in this appendix lists individual industrial/commercial/institutional sources of particulates and SO_2 emissions which might show fuel switching potential. A fuel switch emissions calculation is then made similar to that performed for power plants.

Table D-1. Industrial/Commercial/Institutional Point Source Assessment

AQCR	Plant	Fuel Use: Type[a] % Sulfur % Ash	Fuel Use: Annual Quantity[a]	Fuel Use: Heat Input[b] (10^6 Btu/hr)	Emissions[c] (tons/yr): SO_2	Emissions[c] (tons/yr): Part.	Emissions[c] ($lbs/10^6$ Btu): SO_2	Emissions[c] ($lbs/10^6$ Btu): Part.	% S Assumed	Emissions after Fuel Switch[d] (tons/year): SO_2	Emissions after Fuel Switch[d] (tons/year): Part.
Arizona - New Mexico So. Border	Phelps Dodge, Morenci	Oil 0.55%S	3069×10^3 gal	49	120	23	0.56	0.11	0.55	2608	500
		Gas	8906×10^6 ft^3	1016	3	80	.0006	0.02			
	Phelps DOdge, Cochise	Oil 0.37%S	715×10^3 gal	11.4	21	6	0.42	0.12	0.37	101	29
		Gas	380×10^6 ft^3	43.4	0	0	0	0			
	Phelps Dodge, Douglas	Oil 1.2%S	1215×10^3 gal	19.4	121	15	1.4	0.18	1.2	3296	409
		Gas	4456×10^6 ft^3	509	1	40	.0004	0.02			
	D.C. Speer Const.	Oil 0.3%S	544×10^3 gal	8.7	12	39	0.3	1.02	-	-	-
Phoenix - Tucson											
	American Smelting & Refining, Hayden	Oil 0.35%S	1267×10^3 gal	20.2	32	10	0.36	0.11	0.35	534	167
		Gas	2773×10^6 ft^3	317	1	25	.0007	0.02			

[a] From NEDS (1973)

[b] Heat content of oil assumed to be 140,000 Btu/gallon. Heat content of natural gas assumed to be 1000 Btu/ft^2.

[c] Calculated from fuel use data and EPA emission factors (AP-42)

[d] Convert the amount of natural gas used to an equivalent quantity of oil with the same sulfur content as used in 1973. Increase SO_2 and particulate emissions by direct proportioning assuming all fuel used is oil.

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